

WHAT IS CLAIMED IS:

1. A wound coil member comprising:  
a plurality of first ring layers, each of which is formed so that a wire is wound by a given number of turns concentrically and inwardly; and  
a plurality of second ring layers, each of which is formed so that the wire is wound by a certain number of turns concentrically and outwardly,  
wherein the first ring layers and the second ring layers are alternately aligned in a row.
2. The wound coil member of Claim 1,  
wherein a number of first ring layers is equal to a number of second ring layers.
3. The wound coil member of Claim 1,  
wherein the first ring layer is formed by deforming a first helical portion to form a layer, wherein the first helical portion is formed so that the wire is wound inwardly in a helical shape, and  
wherein the second ring layer is formed by deforming a second helical portion to form a layer, wherein the second helical portion is formed so that the wire is wound outwardly in a helical shape.
4. The wound coil member of Claim 3,  
wherein, owing to elastic deformation generated in the wound coil member after the first and second helical portions are formed, an inner diameter of the wound coil member approximately accords with a target diameter.

5. A method for manufacturing a wound coil member, comprising steps of:

forming a plurality of first ring layers included in the wound coil member, where a wire is wound by a given number of turns concentrically and inwardly; and

forming a plurality of second ring layers included in the wound coil member, where the wire is wound by a certain number of turns concentrically and outwardly,

wherein the first ring layers and the second ring layers are alternately aligned in a row, and

wherein the wound coil member is deformed so that a shape of an inner surface of the wound coil member approximately accords with a shape of an iron core into which the wound coil member is attached.

6. A method for manufacturing a wound coil member, comprising steps of:

forming a plurality of first ring layers included in the wound coil member, where a wire is wound by a given number of turns concentrically and inwardly; and

forming a plurality of second ring layers included in the wound coil member, where the wire is wound by a certain number of turns concentrically and outwardly,

wherein the first ring layers and the second ring layers are alternately aligned in a row, and

wherein the wire is wound so that a shape of an inner surface of the wound coil member approximately accords with a shape of an iron core into which the wound coil member is attached.

7. A compressed coil member that is formed by compressing a wound coil member, the wound coil member comprising:

a plurality of first ring layers included in the wound coil member, each of which is formed so that a wire is wound by a given number of turns concentrically and inwardly; and

a plurality of second ring layers, each of which is formed so that the wire is wound by a certain number of turns concentrically and outwardly, wherein the first ring layers and the second ring layers are alternately aligned in a row,

the compressed coil member formed by compressing and deforming the wound coil member so that the wire has a polygonal cross sectional area.

8. A method for manufacturing a compressed coil member that is formed by compressing a wound coil member including:

a plurality of first ring layers, each of which is formed so that a wire is wound by a given number of turns concentrically and inwardly; and

a plurality of second ring layers, each of which is formed so that the wire is wound by a certain number of turns concentrically and outwardly, wherein the first ring layers and the second ring layers are alternately aligned in a row,

the method comprising:

a preparatory step of deforming the wound coil member so that a shape of an inner surface of the wound coil member approximately accords with a

shape of an iron core into which the wound coil member is attached by applying force to at least one of an outer surface and an inner surface of the wound coil member; and

a compression step of compressing the wound coil so that the wire has a polygonal cross sectional area.

9. A tooth member that is attached, perpendicularly to an axis direction of a rotary electric machine, inside a hollow cylinder defining an outer periphery of the rotary electric machine, the tooth member comprising:

an iron core being a dual trapezoid shape that includes:

a first cross sectional area being perpendicular to the axis direction of the rotary electric machine, and being a trapezoid having two sides that are parallel with each other and perpendicular to the axis direction;

a second cross sectional area being parallel with both of the axis direction and an attachment direction of the tooth member, and being a trapezoid having two sides parallel with the axis direction; and

a third cross sectional area being perpendicular to the attachment direction, and having constant planar dimensions regardless of positions of the attachment direction.

10. The tooth member of Claim 9,

wherein a perimeter of the third cross sectional area partially includes a curved line.

11. The tooth member of Claim 9,  
wherein the tooth member is manufactured by shaping magnetic powder material.

12. An electromagnetic coil manufacturing system for manufacturing an electromagnetic coil using a wire, the system comprising:

a wire feeder which feeds the wire straight; and

a wire bender located on an outlet side of the wire feeder, which bends the wire in a predetermined inclination and a curvature, and releases the wire with the curvature so as to form the wire into a helical coil, wherein

the wire bender includes a movable member which continuously varies the curvature of the wire by moving in an oscillating fashion so that the helical coil is formed with an alternating diameter along an axial direction of the helical coil.

13. The electromagnetic coil manufacturing system of claim 12, further comprising an axial compressing stage in which the helical coil is compressed in an axial direction of the helical coil to form an axially compressed coil.

14. The electromagnetic coil manufacturing system of claim 13, further comprising a deforming stage in which the axially compressed coil is further compressed to deform a cross-sectional shape of the wire in order to squeeze spaces therebetween.

15. The electromagnetic coil manufacturing system of claim 12, wherein the wire bender further includes:

a primary axis member into which the wire is continuously fed, wherein the primary axis member faces the movable member via the wire.

16. The electromagnetic coil manufacturing system of Claim 15, wherein a contact surface of the primary axis member that makes contact with the wire faces, with an inclination corresponding to the predetermined inclination, a contact surface of the movable member that makes contact with the wire so that the wire is bent with the predetermined inclination.

17. The wound coil member of Claim 1, wherein the wound coil member is manufactured by a wound coil manufacturing system that includes:

a wire feeder which feeds the wire straight; and

a wire bender located on an outlet side of the wire feeder, which bends the wire in a predetermined inclination and a curvature, and releases the wire with the curvature so as to form the wire into a helical coil,

wherein the wire bender includes a movable member which continuously varies the curvature of the wire by moving in an oscillating fashion so that the helical coil is formed with an alternating diameter along an axial direction of the helical coil.

18. The method of Claim 8 for manufacturing a compressed coil member,

wherein the wound coil member that is compressed to form the compressed coil member is manufactured by a wound coil manufacturing system that includes:

a wire feeder which feeds the wire straight; and

a wire bender located on an outlet side of the wire feeder, which bends the wire in a predetermined inclination and a curvature, and releases the wire with the curvature so as to form the wire into a helical coil,

wherein the wire bender includes a movable member which continuously varies the curvature of the wire by moving in an oscillating fashion so that the helical coil is formed with an alternating diameter along an axial direction of the helical coil.

19. A core comprising:

a compressed coil member; and

a tooth member into which the compressed coil member is attached,

wherein the compressed coil member is formed by compressing and deforming a wound coil member so that a wire has a polygonal cross sectional area, the wound coil member including:

a plurality of first ring layers included in the wound coil member, each of which is formed so that the wire is wound by a given number of turns concentrically and inwardly; and

a plurality of second ring layers, each of which is formed so that the wire is wound by a certain number of turns concentrically and outwardly, wherein the first ring layers and the second ring layers are alternately aligned in a row, and

wherein the tooth member is attached, perpendicularly to an axis direction of a rotary electric machine, inside a hollow cylinder defining an outer periphery of the rotary electric machine, the tooth member including an iron core being a dual trapezoid shape that includes:

a first cross sectional area being perpendicular to the axis direction of the rotary electric machine, and being a trapezoid having two sides that are parallel with each other and perpendicular to the axis direction;

a second cross sectional area being parallel with both of the axis direction and an attachment direction of the tooth member, and being a trapezoid having two sides parallel with the axis direction; and

a third cross sectional area being perpendicular to the attachment direction, and having constant planar dimensions regardless of positions of the attachment direction.

20. A rotary electric machine comprising a core that includes:

a compressed coil member; and

a tooth member into which the compressed coil member is attached,

wherein the compressed coil member is formed by compressing and deforming a wound coil member so that a wire has a polygonal cross sectional area, the wound coil member including:

a plurality of first ring layers included in the wound coil member, each of which is formed so that the wire is wound by a given number of turns concentrically and inwardly; and

a plurality of second ring layers, each of which is formed so that the wire is wound by a certain number of turns concentrically and



outwardly, wherein the first ring layers and the second ring layers are alternately aligned in a row, and

wherein the tooth member is attached, perpendicularly to an axis direction of the rotary electric machine, inside a hollow cylinder defining an outer periphery of the rotary electric machine, the tooth member including an iron core being a dual trapezoid shape that includes:

a first cross sectional area being perpendicular to the axis direction of the rotary electric machine, and being a trapezoid having two sides that are parallel with each other and perpendicular to the axis direction;

a second cross sectional area being parallel with both of the axis direction and an attachment direction of the tooth member, and being a trapezoid having two sides parallel with the axis direction; and

a third cross sectional area being perpendicular to the attachment direction, and having constant planar dimensions regardless of positions of the attachment direction.